NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Clean Cities 2010 Annual Metrics Report

Caley Johnson

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Technical Report
NREL/TP-7A30-52714
October 2012

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Table of Contents

List of Figures

List of Tables

Introduction

Each year, the U.S. Department of Energy (DOE) asks Clean Cities coordinators to submit an annual report of their activities and accomplishments for the previous calendar year. Data and information are submitted to an online database that is maintained as part of the Alternative Fuels and Advanced Vehicles Data Center (AFDC) at the National Renewable Energy Laboratory (NREL). Coordinators submit a range of data that characterizes the membership, funding, projects, and activities of their coalitions. They also submit data about sales of alternative fuels, deployment of alternative fuel vehicles (AFVs) and hybrid electric vehicles (HEVs), idle reduction initiatives, fuel economy activities, and programs to reduce vehicle miles traveled (VMT). NREL analyzes the data and translates them into gasoline use reduction impacts, which are summarized in this report.

All 88 coalitions that were active throughout 2010 completed their reports, making this the first year the response rate has been 100%. The coalitions that submitted their 2010 annual reports are listed in the appendix to this report. Coalition coordinators assembled the data based on voluntary reports from their stakeholders—the private and public entities that are members of the coalitions. As such, these reports represent just a subset of the Clean Cities activities throughout the nation, but they are an important indicator of the impact coalitions and petroleum-saving technologies have at the local level.

In addition to collecting data through the coordinator reports, NREL compiles metrics about activities funded by the Clean Cities program at NREL and Oak Ridge National Laboratory (ORNL). NREL provides a range of technical data, tools, and resources to support coalitions in their efforts to accelerate the use of alternative fuels, advanced vehicles, and other technologies. ORNL produces the Fuel Economy Guide and the FuelEconomy.gov website and provides a range of public information related to fuel economy. Metrics pertaining to the use and impact of these resources are also presented in this report.

A detailed breakdown of the data used to produce this and previous reports can be accessed at www.eere.energy.gov/afdc/data/cleancities.html.

Summary of Key Findings

Clean Cities activities saved[1] approximately 645 million gallons of gasoline in 2010. Figure 1 represents the combined results of the three tiers of petroleum savings: "reported savings" resulting from activities reported by coalitions (as analyzed by NREL), "estimated lab savings" (estimated by NREL and Oak Ridge National Laboratory, ORNL) resulting from the Fuel Economy Guide and the Alternative Fuels and Advanced Vehicles Data Center (AFDC), and "estimated outreach savings" resulting from coalition outreach, education, and training events (as estimated by NREL and ORNL). As shown in Figure 1, the reported petroleum savings increased 7% from 2009 while the estimated lab savings decreased 33% and estimated outreach savings

[1] The petroleum saved includes both gasoline and diesel. Petroleum savings in this report have been converted to gasoline-gallon equivalents (GGE), using the lower heating value ratio of the fuels.

increased 10%. Overall petroleum savings decreased 4% in 2010, but the Clean Cities program is still ahead of schedule to meet its goal of 2.5 billion gallons per year by 2020.

Table 1. Petroleum Savings of Each Portfolio Element

	Technology	Million GGEs Saved	Percent of Total Reported Savings	Increase from Last Year
Reported Savings	Alt. Fuels and Vehicles	258.7	76.9%	-5%
	Idle Reduction	25.1	7.5%	71%
	VMT Reduction	23.2	6.9%	307%
	HEVs	17.1	5.1%	-6%
	Off-Road	8.0	2.4%	1240%
	Fuel Economy	4.4	1.3%	70%
	Total* Reported Savings	336.6	100%	7%
Estimated Lab Savings	ORNL Fuel Economy	71.7	–	-45%
	AFDC	53.6	–	-6%
	Total Estimated Lab Savings	125.2	–	-33%
Estimated Outreach Savings	Total Estimated Outreach Savings	183.0	–	10%
	Grand Total	644.8	–	-4%

* Totals do not fully add up due to rounding.

Coalition reported projects prevented more than 1.6 million tons of carbon dioxide equivalent (CO_2e) from being emitted to the atmosphere. Outreach events, FuelEconomy.gov, and the AFDC kept another 2.9 million tons of CO_2e out of the atmosphere, for a total of 4.5 million tons. This GHG emissions reduction is the equivalent of removing 842,000 cars from the roads.

In addition to petroleum savings and greenhouse gas (GHG) reductions, a remarkable achievement of the coalitions was their ability to leverage the DOE investment. In 2010, the coalitions won 198 project awards (project-specific grants) worth a total of $232.4 million and another $319.8 million in leveraged funds from coalition members. This funding represents a 22:1 leveraging of the $25.5 million program budget in fiscal year (FY) 2010. Clean Cities coalitions received $157.6 million in American Recovery and Reinvestment Act awards, matched them with $241.0 million in leveraged funds, and utilized it to better equip the United States to use alternative fuels and advanced vehicles.

Clean Cities coordinators spent almost 129,000 hours pursuing Clean Cities' goals in 2010, which is like having a national network of 66 full-time technical sales professionals working to reduce U.S. dependence on oil. Coordinators logged 1,687 outreach, education, and training activities in 2010, which reached an estimated 133 million people. The general public was the most common audience of these events, followed by government fleets. AFVs were the most popular subject of these activities, as has generally been the case in the past. HEV outreach events rose in popularity in 2010 to tie fuel blends as the second-most-popular subject.

Changes to 2010 Annual Metrics Report

The 2010 Annual Metrics Report separates reported, estimated lab, and estimated outreach petroleum saving categories more clearly than in previous years. Reported petroleum savings are directly calculated from the fuel and vehicle use reported by Clean Cities coordinators. Estimated lab petroleum savings are estimated by NREL and ORNL from lab-run websites that inform vehicle operators about available petroleum-reducing fuels and technologies. Estimated outreach petroleum savings account for petroleum savings resulting from coalition outreach events. The estimation methodology for the latter two categories is detailed in the Estimated Petroleum Savings section of this report. GHG emissions reductions are reported for all three tiers of petroleum reduction. All vehicle and infrastructure statistics are reported directly from coalitions and are therefore reported rather than estimated.

Other changes in the 2010 Annual Metrics Report reflect changes made in the annual reporting website. Numerous modifications added new capabilities and improved accuracy and increased the ease of reporting. In 2010, NREL made the following improvements to the reporting website:

- Added a new tool to help coordinators estimate a coalition's contribution to any given project. As explained in the next section, this estimate determines how much of a project's petroleum savings is attributed to the coalition.
- Split the niche markets for AFVs into two entries: Vehicle Market and Vehicle Type. This allows for greater flexibility and precision when reporting and tracking AFVs. New, specific default assumptions were tied to these vehicles, providing greater accuracy than the previous defaults, which were broadly tied to light-duty vehicles (LDVs) or heavy-duty vehicles (HDVs).
- Added a flexible fuel vehicle (FFV) estimator to back-calculate the number of FFVs that use a given amount of E85.
- Combined the Biodiesel Blends category with the Alternative Fuel Vehicles category to create a new "Alternative Fuels and Vehicles" category. If a biodiesel blend is higher than 20%, the vehicles using it need to be specialized and are considered AFVs. Therefore, the website requests the number of AFVs if a reported biodiesel blend is higher than 20%.
- Added questions to the reporting website to enable Clean Cities headquarters to track the amount of a project award or matching funds spent in a given year. The question is asked outright, but if the coordinator doesn't know the amount spent in a given year, he or she can simply report the award amount and the duration of the award, and the website will estimate the amount spent per year.

- Added “mining equipment” to the list of vehicle applications in the off-road section.
- Added “telecommute” to the list of project types in the VMT reduction section.

Attribution and Fuel Use Factors

To clarify the link between coalition activities and end results, the coalition annual report includes an attribution factor that accounts for the percentage of a project’s outcome that may be due to coalition activities rather than to those of other participants in a project. This attribution factor was used in the estimates of impacts for fuel economy, VMT reduction, idle reduction, alternative fuel use, and outreach projects. Coordinators entered the percentage of the project’s outcome they estimated their coalition was responsible for, and the project’s overall outcome was multiplied by that percentage to determine the coalition’s impact. Although subjective, this method attempts to address the issue of attribution where a coalition is one of several partners involved in a project. To reduce the subjectivity of this factor, NREL added a tool that helps estimate a coalition’s contribution to any given project.

Reported Petroleum Savings

Coordinators submitted information on their petroleum use reductions, broken down according to the technologies in the Clean Cities portfolio. NREL analyzed the data, converted it into a quantity of gasoline saved by each element, and reported in units of gasoline-gallon equivalents (GGEs)—the amount of energy contained in a gallon of gasoline. As shown in Table 1, about 337 million GGEs (MGGEs) were saved through primary Clean Cities coalition efforts in 2010—an average of 3.8 MGGEs per coalition. This is 6.8% higher than the total 2009 petroleum savings of 315 MGGEs. In addition, coalition outreach activities displaced an estimated 183 MGGEs. Petroleum displaced by ORNL’s fuel economy guide and NREL’s AFDC then boosts the total Clean Cities effort by 72 MGGEs and 54 MGGEs (respectively) for a total displacement of 645 MGGEs.

Alternative Fuels and Vehicles

As shown in Table 1, alternative fuels (used in AFVs and in biodiesel blends) accounted for 259 million gallons, or 77% of the coalitions’ reported reductions in petroleum use. This represents a decrease of 5% relative to the petroleum saved by AFVs and blends in 2009.

In 2010, coalitions reported a total inventory of nearly 563,000 AFVs, split among nine vehicle types (Figure 1). The biodiesel category increased more than 30-fold this year because coordinators were allowed to report vehicles using mid-level blends for the first time. Vehicles in the “other” category increased eightfold, partially because some coordinators mistakenly reported HEVs in this category. The liquefied natural gas (LNG) and liquefied petroleum gas (LPG, or propane) categories both increased by 66% this year, while EVs increased by 23%. The numbers of hydrogen vehicles, neighborhood electric vehicles (NEVs), and E85 FFVs all decreased this year (16%, 21%, and 37%, respectively).

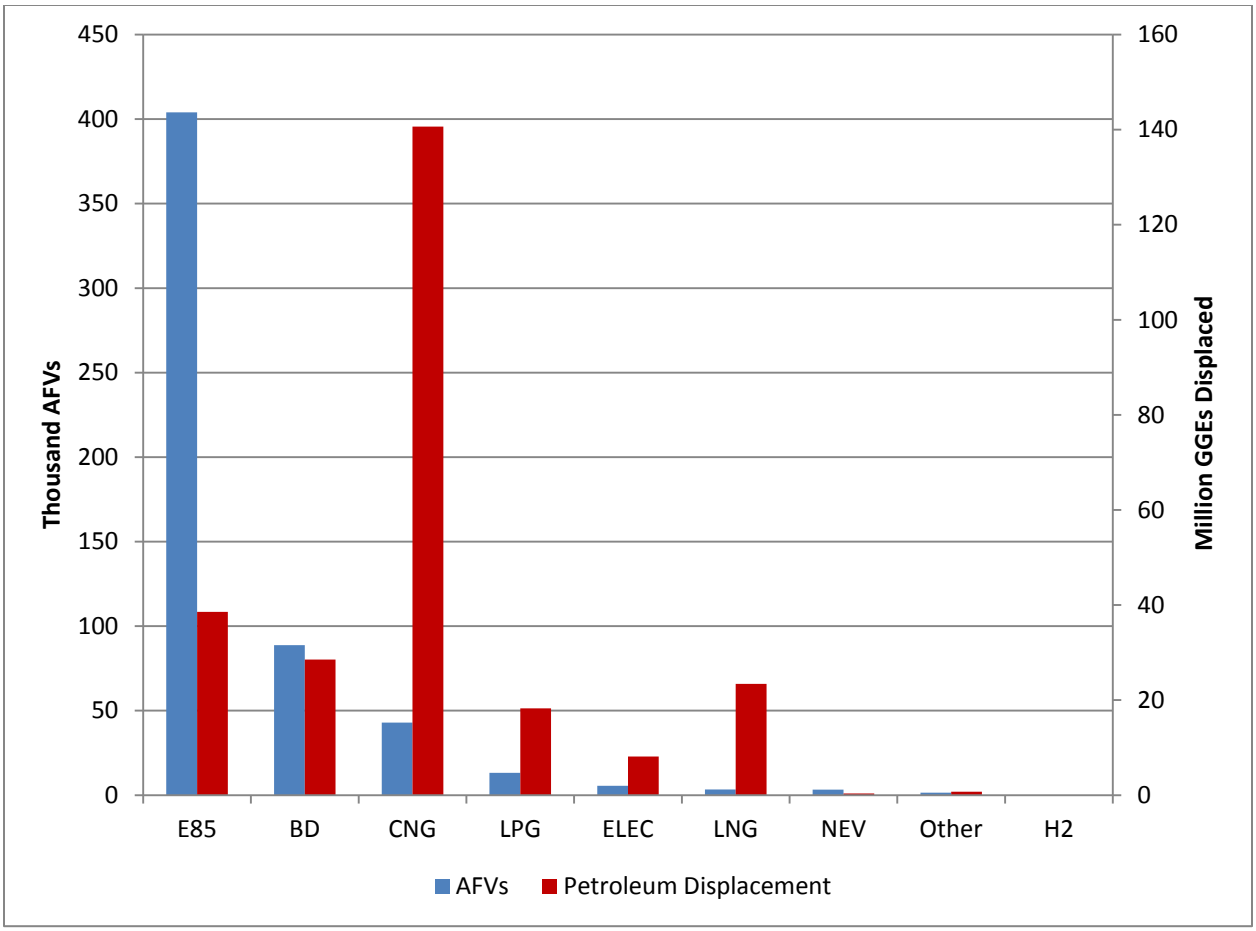

Figure 1. Number of AFVs and petroleum savings from fuel type

Figure 1 shows the total GGEs saved by AFVs according to fuel type. CNG remains at the top of the list, accounting for 54% of the total AFV petroleum use reduction, despite that only 8% of the AFVs used CNG. This is in stark contrast to E85, which accounts for only 15% of the AFV petroleum savings, despite that 72% of reported AFVs can use E85.

Some interesting trends and reporting problems can be revealed by comparing the AFV trends with the fuel use trends. The number of CNG vehicles stayed even from 2009 to 2010, while their petroleum savings increased 65%. This trend possibly indicates that CNG vehicles are being placed in fleets with high fuel use, where project economics are more favorable[2] (Johnson 2010). The number of vehicles using LPG increased 66% while their petroleum savings remained constant, possibly reflecting improved data keeping from coordinators who previously tracked fuel through a fueling station and now report the number of vehicles using that fuel. Electric vehicles (EVs) increased 23% while their petroleum savings decreased 72%, most likely because some coordinators did not know how much electricity the EVs used and mistakenly defaulted to 0 kWh during their reporting. Biodiesel displacement didn't increase nearly as much

[2] Johnson, C. (2010). Business Case for Compressed Natural Gas in Municipal Fleets. NREL/TP-7A2-47919. Golden, CO: National Renewable Energy Laboratory.

as the number of vehicles using biodiesel did, which probably reflects the fact that the vehicles added to the report this year are using low-level blends.

Fourteen percent of the reported AFVs were HDVs—an increase of 10 percentage points from 2009. This 14% of the AFVs is responsible for 73% of the petroleum savings, most likely because HDVs use more fuel per vehicle than LDVs do, and because most use alternative fuel all the time instead of occasionally (like light-duty FFVs do). Furthermore, the use of LNG is confined almost exclusively to HDVs. Sixty-three percent of the petroleum savings from biodiesel, about 36% of the savings from CNG, and about 31% of the savings from LPG occurred in HDVs.

Hybrid Electric Vehicles

The number of HEVs resulting from Clean Cities efforts was nearly 31,000 in 2010, about 5% of the total vehicles (AFVs plus HEVs) reported. This represents a decrease of more than 70% from those reported in 2009. This decrease is partially due to coordinators erroneously reporting HEVs in the AFVs "other vehicle" section. The use of these vehicles in place of conventional vehicles saved 17 million GGEs in 2010, a 6% decrease from 2009. An increasing per-vehicle petroleum savings largely counteracted the overall reduction in number of vehicles.

Plug-in HEVs (PHEVs) increased from 78 to 397 from 2009 to 2010, indicating that Clean Cities is expanding the use of this cutting-edge technology.

Fuel Economy

Petroleum savings from fuel economy projects in coalitions increased 70% in 2010, to 4.4 MGGEs. This savings resulted from 9,623 vehicles, for an average displacement of nearly 460 GGEs per vehicle. As shown in Figure 2, some fuel economy improvement projects were much more effective at reducing GGEs than others.

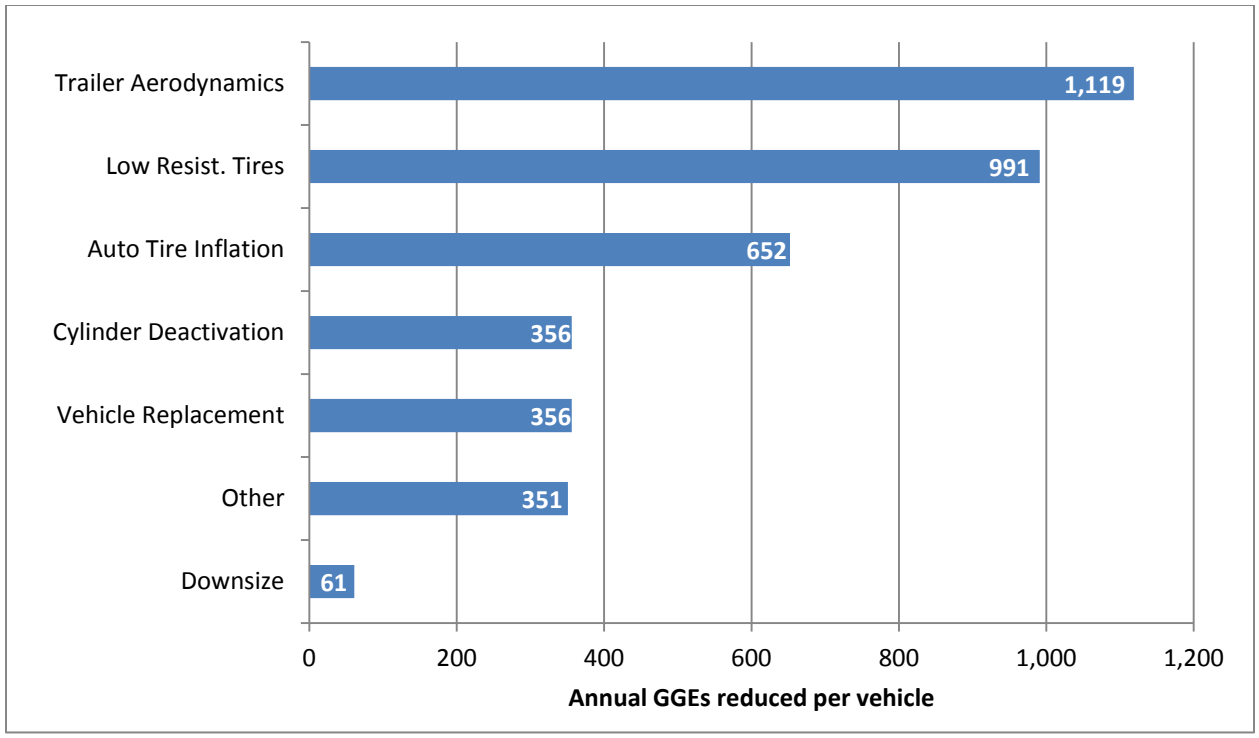

Figure 2. Average fuel reduction per vehicle for fuel economy projects in 2010

VMT Reduction

VMT reduction projects save fuel by reducing the miles that vehicles travel. They include methods such as carpooling, biking, telework, and public transportation. Nearly half of the coalitions reported at least one VMT reduction project in 2010—a 45% increase from last year. This increase in popularity could be due to an increase of their discussion at Clean Cities venues, including a VMT-reduction webinar. The average number of projects per participating coalition increased from three in 2009 to four in 2010. Furthermore, the displacement from an average project doubled in 2010. These three factors of growth led to a tripling of petroleum saved through VMT reduction, from 5.7 million gallons in 2009 to 23.2 million gallons in 2010. This is the second-highest-growth category in 2010.

Idle Reduction

Idle reduction (IR) strategies include truck-stop electrification (TSE), onboard idle reduction, and idle reduction policies. Estimated fuel savings for idle reduction technologies was 25.1 MGGEs in 2010. As shown in Figure 3, onboard idle reduction technologies accounted for 52% of the savings estimated for the three technologies; idle reduction policies accounted for 41%; and truck-stop electrification accounted for 7%.

The total fuel displaced by idle reduction (25.1 MGGEs) is up 71% from 14.7 MGGEs in 2009. This difference is largely due to the increase (130%) in fuel savings from onboard idle reduction. Fuel savings from idle reduction policies also saw a substantial gain (59%) from last year while, petroleum savings from truck-stop electrification decreased 27%.

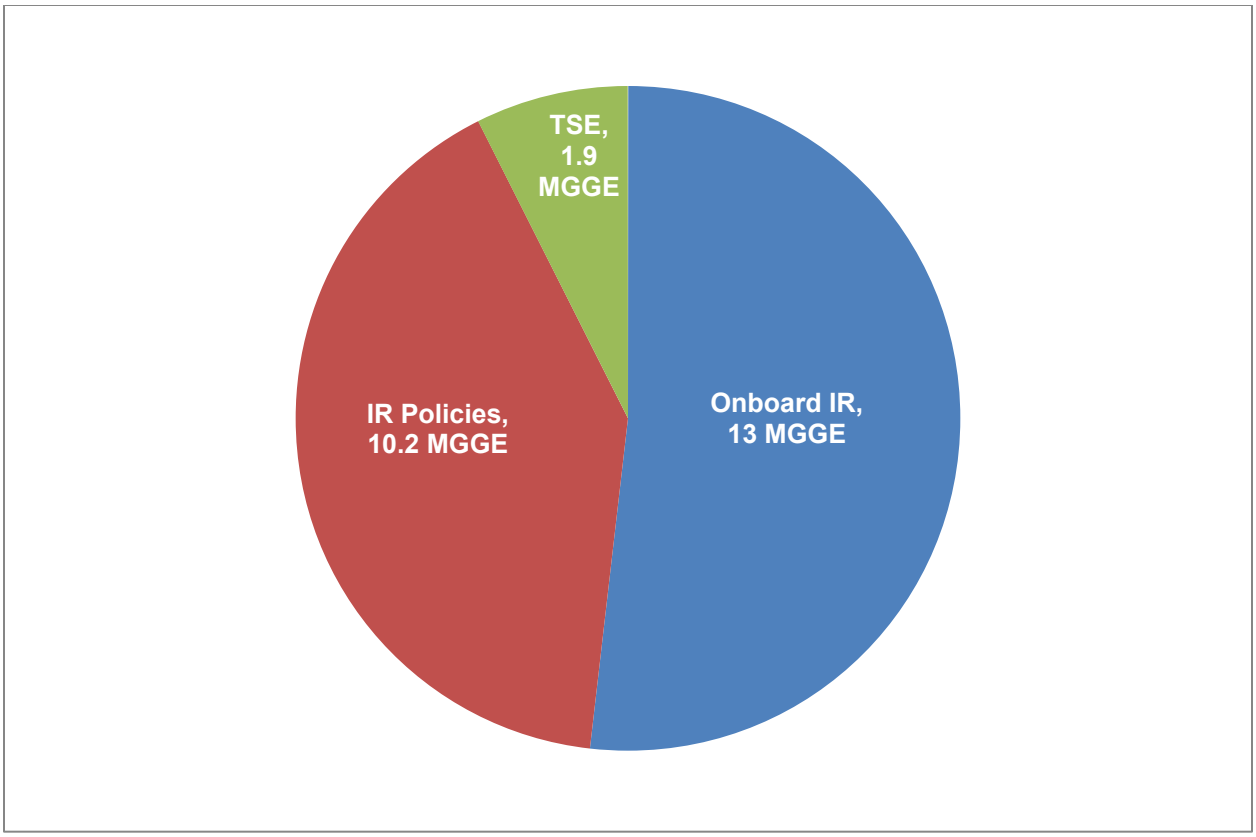

Figure 3. Fuel savings due to idle reduction projects, in MGGEs

Estimated Petroleum Savings

Estimated petroleum savings are estimated from two activities: national lab activities, such as the Fuel Economy Guide and the AFDC website, and coalition outreach events. Both these activities impact people's actions, such as vehicle purchases, fuel choice, driving and maintenance behavior, and transportation patterns. These petroleum savings have a greater degree of uncertainty but are calculated using a sound estimation technique. This section explains this technique and addresses the results from the two main activities.

Estimating Petroleum Reduction from Websites and Outreach Activities

2010 is the second year that petroleum use reduction was attributed to websites and outreach events held by Clean Cities coalitions. To estimate the size of these savings, NREL and ORNL developed the Petroleum Impact Model (PIM), and NREL added related functionality to the Clean Cities annual report website.

Clean Cities coordinators input the type of outreach event, the number of people reached by each event, the technologies presented, and the coalition's percent attribution. To determine how many people were reached by a given event, the annual report website multiplied the audience number by the percent attributed to the coalition. When multiple technologies were presented in a given event, the annual report website assumed the people reached to be divided evenly among

the technologies. This data is then entered into the PIM as the "persons reached by the coalition about a given technology."

The PIM multiplies this persons-reached number by the probability they will take action (which means purchase an AFV or more efficient vehicle, or change their driving or fueling behavior). This probability is derived by comparing the outreach event and technology to comparable marketing media and products. Eleven of these media-product combinations have a "Customer Conversion Ratio" that is recorded by various marketing firms as shown in Table 2. The customer conversion ratio is the ratio of purchases made (desired action) over the total number of people who came into contact with the outreach. The code in Table 2 is provided for continuity through the calculation process.

Table 2. Benchmark Customer Conversion Rates and Their Sources.

Code	Benchmark Conversion Rate	Reference
1	0.6% for electronics (expensive, complicated) websites	Fireclick.com. Accessed June 16, 2011
2	1.3% for environmentally related, incremental cost purchase	Bird, Lori. 2004. Utility Green Pricing Programs: Design, Implementation, and Consumer Response
3	2% for common websites	Fireclick.com. Accessed June 16, 2011
4	2.5% conversion for industry-specific mail	Direct Marketing Association (DMA). 2011
5	3.2% for emails	Fireclick.com. Accessed June 16, 2011
6	7% for affiliates	Fireclick.com. Accessed June 16, 2011
7	Copyright restriction. AdMeasure product: LDVs	GfK Mediamark Research & Intelligence, LLC. 2011
8	Copyright restriction. AdMeasure product: Gasoline	GfK Mediamark Research & Intelligence, LLC. 2011
9	Copyright restriction. AdMeasure Stop-smoking "actions taken"	GfK Mediamark Research & Intelligence, LLC. 2011
10	2% for direct mail to current customers	www.clickz.com/clickz/column/1718099/the-average-conversion-rate-is-it-myth

For activity-type–audience-action combinations that weren't directly addressed by research, NREL adjusted the customer conversion ratios based on the Ostrow Model of Effective Frequency, Krugman's Three Exposure Theory, and the author's assumptions. Table 3 lists a set of relationships that increase or decrease the impact of advertisements.

Table 3. Relationships for Media Effectiveness and Their Sources.

Code	Relationships	Source
A	Degree of media interactivity increases impact	Ostrow Model of Effective Frequency
B	Brand recognition increases impact	Ostrow Model of Effective Frequency
C	Long purchase cycle increases impact	Ostrow Model of Effective Frequency
D	Less frequent usage of item increases impact	Ostrow Model of Effective Frequency
E	Affordability of item increases impact	Ostrow Model of Effective Frequency
F	Simple message increases impact	Ostrow Model of Effective Frequency
G	Media clarity (not cluttered) increases impact	Ostrow Model of Effective Frequency
H	Message in relevant environment increases impact	Ostrow Model of Effective Frequency
I	Audience attentiveness increases impact	Ostrow Model of Effective Frequency
J	More steps in processing the media increases impact	Krugman's Three Exposure Theory
K	Availability of item increases impact	Author's assumption
L	Length of vigilance required decreases impact	Author's assumption

The benchmark conversion rates shown in Table 2 were adjusted by the relationships for media effectiveness shown in Table 3. The direct application of these rates and relationships is shown in Table 3, where the number relates to the code in Table 2, and the letters relate to the code in Table 3. The final customer conversion ratios used are displayed in Table 5.

Table 4. Combination of Benchmarks and Relationships.

Activity Type	Purchase new AFV	Use alt fuel in existing vehicle	Use biodiesel blends in diesel vehicle	Purchase more efficient car	Operate vehicle more efficiently	Purchase HEV	Reduce idling	Idle reduction HDV (equip purchase)	Reduce vehicle miles travelled
Advancing the Choice	6+H+I+J-E	6+H+I+J	6+H+I+J	6+H+I+J	6+H+I+J	6+H+I+J-E	6+H+I+J	6+H+I+J-E	6+H+I+J
Advertisement	7-K	8-K-L	8-K-L	7+E	9-G-L	7-K	9-L	7+E	9-L
Conference	6+H+J-E	6+H+J	6+H+J	6+H+J	6+H+J	6+H+J-E	6+H+J	6+H+J-E	6+H+J
Literature Distribution	4+B+H-E	4+B+H	4+B+H	4+B+H	4+B+H	4+B+H-E	4+B+H	4+B+H-E	4+B+H

Media Event	7-E-G-H	8-G-H	8-G-H	7-G-H+E	9-G-H	7-E-G-H+B	9-G-H	7-E-G-H	9-G-H
Meeting	6+A+B+I-E	6+A+B+I	6+A+B+I	6+A+B+I	6+A+B+I	6+A+B+I-E	6+A+B+I	6+A+B+I-E	6+A+B+I
Website	1+B+J	3+B+J	3+B+J	3+B+J	3+B+J	1+B+J	3+B+J	1+B+J	3+B+J

Note that adjustments to the customer conversion factors were made since 2009 in response to a few projects that were large enough to effect the average characteristics for an entire category. In general, assumed effectiveness of advertisements raised slightly, and assumed effectiveness of media events are lowered slightly. It should also be noted that the 62 million people reached through the Twin Cities media coverage were excluded from this estimate, because the coverage was on hydraulic hybrids, which are not readily available for purchase.

Table 5. Customer Conversion Ratios Used in the PIM

Activity Type	Purchase new AFV	Use alt fuel in existing vehicle	Use biodiesel blends in diesel vehicle	Purchase more efficient car	Operate vehicle more efficiently	Purchase HEV	Reduce idling	Idle reduction HDV (equip purchase)	Reduce vehicle miles travelled
Advancing the Choice	2.0%	6.0%	6.0%	5.0%	7.0%	2.0%	5.0%	4.0%	8.0%
Advertisement	0.6%	5.5%	5.5%	2.0%	10.0%	2.0%	10.0%	3.0%	4.0%
Conference	2.0%	6.0%	6.0%	5.0%	7.0%	2.0%	5.0%	4.0%	8.0%
Literature Distribution	2.0%	3.0%	3.0%	2.5%	3.0%	2.5%	3.0%	2.5%	5.0%
Media Event	0.6%	4.0%	5.0%	2.0%	6.0%	2.0%	8.0%	3.0%	3.0%
Meeting - Other	2.0%	7.0%	6.0%	5.0%	7.0%	2.0%	5.0%	4.0%	8.0%
Website	2.0%	4.0%	3.0%	3.0%	4.0%	3.0%	3.0%	1.0%	3.0%

The persons-reached multiplied by the appropriate customer conversion ratio (from Table 5) results in the number of people assumed to take the intended action. At this point, the PIM is similar to the Clean Cities annual reporting tool, as it converts the estimated number of vehicles purchased or number of people changing their driving habits into reduced petroleum use. Reductions are made for probable overlap between those attending outreach events and those reporting their real savings through a Clean Cities coalition. Only the petroleum saved during that given year is accounted for even though many of the vehicle purchases and behavioral

changes will likely last beyond the year. The PIM estimates that 183 MGGEs of petroleum were saved by 2010 outreach events.

The PIM was also used to estimate the petroleum savings resulting from the AFDC. Web statistics are kept on the AFDC that enable the estimation of individual users. The PIM then used similar inputs, defaults, and methodologies as it did to calculate the savings from coalition websites portion of the outreach events (including the website row of Table 2) to estimate the displacement from the AFDC. This resulted in an estimated petroleum savings of 54 MGGEs from actions that the AFDC instigated or enabled. An ORNL model similar to the PIM was used to estimate the petroleum savings resulting from the Fuel Economy Guide.

National Lab Activities

Both NREL and ORNL track the use of their information and resources. On behalf of Clean Cities, ORNL produces the Fuel Economy Guide based on fuel economy data from the Environmental Protection Agency. In addition, ORNL produces and maintains the FuelEconomy.gov website, along with other print and educational activities related to fuel economy. By tracking the number of new car buyers, used car buyers, and car drivers exposed to fuel economy products through their educational materials and assuming a 1% – 3.3% improvement in fuel economy per customer, ORNL estimated that the fuel economy materials resulted in a savings of 72 million gallons of gasoline in 2010.

Online resources produced by NREL reached a large audience in 2010, as users accessed 3.5 million pages of information on the Clean Cities and AFDC websites. The sites at www.eere.energy.gov/cleancities and www.afdc.energy.gov/afdc/ provide a range of resources to support coordinators, fleets, businesses, and local decision-makers in their efforts to implement the technologies of the Clean Cities portfolio. The sites' content includes technical data, success stories, publications, and industry contacts, along with databases of federal and state incentives and laws, fuel station locations, available vehicles, and other information and tools.

NREL estimated that the 3.2 million page views, 712,000 visits by 504,000 users of the AFDC resulted in a petroleum savings of 54 MGGEs in 2010. The Clean Cities website received 265,000 page views through 72,500 visits from 45,500 visitors. Petroleum use reduction estimates were not made for the Clean Cities website, because the majority of visits to the Clean Cities website are assumed to be related to Clean Cities activities taking place through coalitions, and those activities are already reported by the coalitions. Nor were petroleum reduction estimations made for other Clean Cities activities performed by NREL such as webinars, technical advice, presenting at conferences, and publications. These were not accounted for this year because NREL did not track how many people were contacted through these events, but they will be included next year.

Outreach, Education, and Training Activities

Outreach, education, and training activities were classified into eight categories, as shown in Table 6. A total of 1,687 activities were reported and were estimated to reach nearly 133 million people. Compared to 2009, the number of events decreased 14%, while the number of persons reached increased 83%, suggesting much larger events in 2010. This trend was largely created by two major media events executed by the Twin Cities and Ann Arbor coalitions. These media events reached 63 and 51 million people, respectively, through media outlets such as CNN

Money, FOX Business, Reuters, USA Today, and Time Magazine. Therefore, the majority of people (90%) were reached through media events despite the fact that only 13% of the outreach activities were media events. Meetings were the most common type of outreach event (36%) but reached less than 1% of the outreach audience. However, these numbers do not necessarily reflect the actual impact that each event had on the audience, which were estimated on page 8 of this report.

Table 6. Outreach, Education, and Training Activities

Activity Type	Persons Reached	% of all people reached	No. of Activities	% of All Activities
Media Event	119,631,331	90.3%	219	13.0%
Advertisement	5,614,273	4.2%	27	1.6%
Website	3,137,743	2.4%	30	1.8%
Advancing the Choice	1,695,114	1.3%	359	21.3%
Meeting	1,064,366	0.8%	602	35.7%
Literature Distribution	1,004,364	0.8%	198	11.7%
Conference	353,246	0.3%	203	12.0%
Legislation	5,079	0.0%	49	2.9%
TOTAL	132,505,516	100.0%	1,687	100.0%

Figure 4 illustrates the types of audiences that the 1,687 outreach activities attempted to reach. Any one activity could be aimed at more than one audience; in fact, each activity targeted an average of 3.5 different audiences. The general public was most often cited as a target audience, followed by government fleets, and then fleets in general. Specialized applications—mass transit, utility trucks, delivery trucks, waste management, and airports—were identified as audiences in nearly 36% of the outreach activities. “Other” audiences were cited as audience types in 9% of the activities reported.

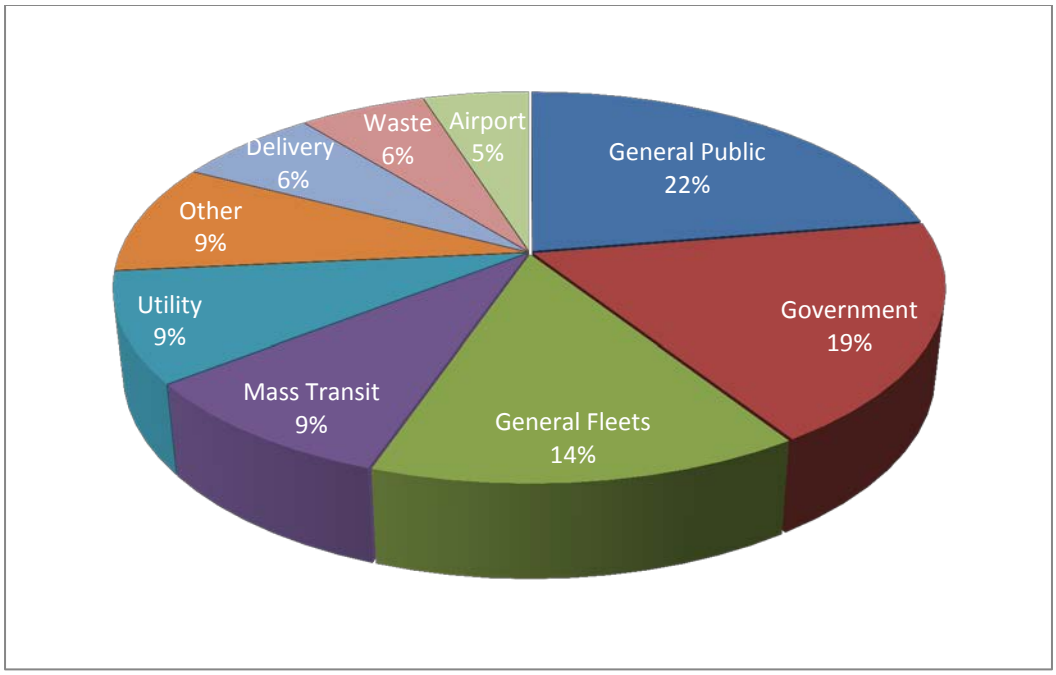

Figure 4. Percent of outreach activities split among audience types

Figure 5 shows that AFVs were the technology most often targeted during outreach activities. Coverage has increased this year for all technologies except VMT reduction. Just as with audience types, any one activity could be centered on more than one technology; in fact, each activity targeted an average of 3.4 different technologies.

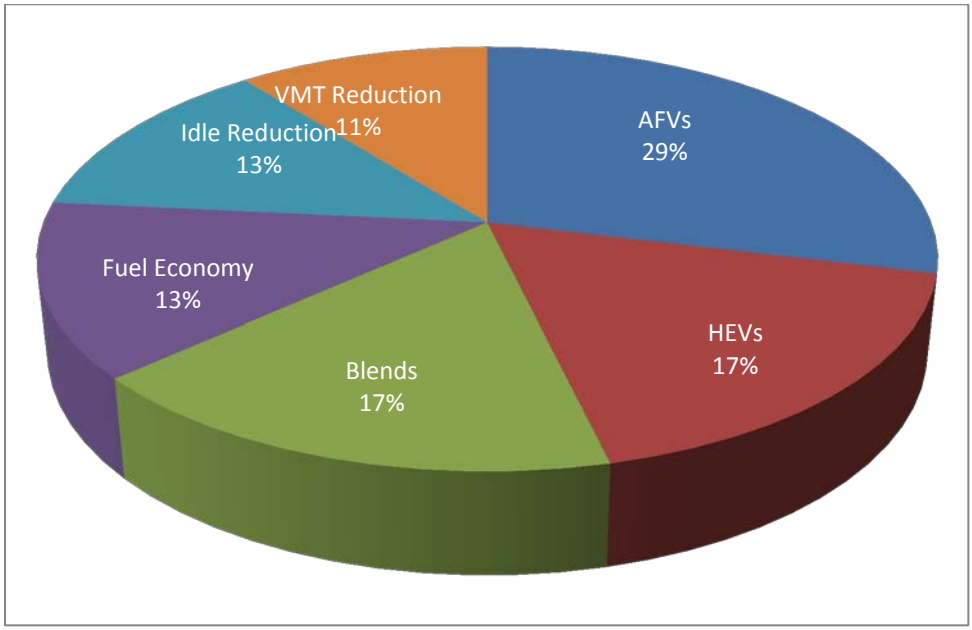

Figure 5. Percent of outreach activities by technology type

NREL and ORNL developed a model to estimate the petroleum use reductions associated with coalition outreach events. This Petroleum Impacts Model (PIM) estimates that Clean Cities

outreach events prompted and enabled actions that saved 183 MGGEs of petroleum in 2010. PIM and the estimation methods are explained in more detail on page 8.

Goal Tracking

In 2005, Clean Cities set a goal of displacing 2.5 billion GGEs per year by 2020. The data presented in this report show that Clean Cities is slightly ahead of schedule to meet this goal. There was a slight backslide in 2010, largely due to reduced savings from ORNL's fuel economy outreach activities. This reduction likely resulted from the popularity of ORNL'S materials dropping back to normal in 2010 after the 2009 Cash for Clunkers program ended.

Progress toward the goal is shown in Figure 6, where the path toward achieving the 2020 goal is represented by the blue dashed line, and actual petroleum savings are tracked by the black solid line. When the goal was originally set in 2005, meeting it required a compounded annual growth rate of 16.6%. However, because of higher-than-projected petroleum savings in subsequent years, the average growth rate required henceforth to meet the 2020 goal is 14.5%.

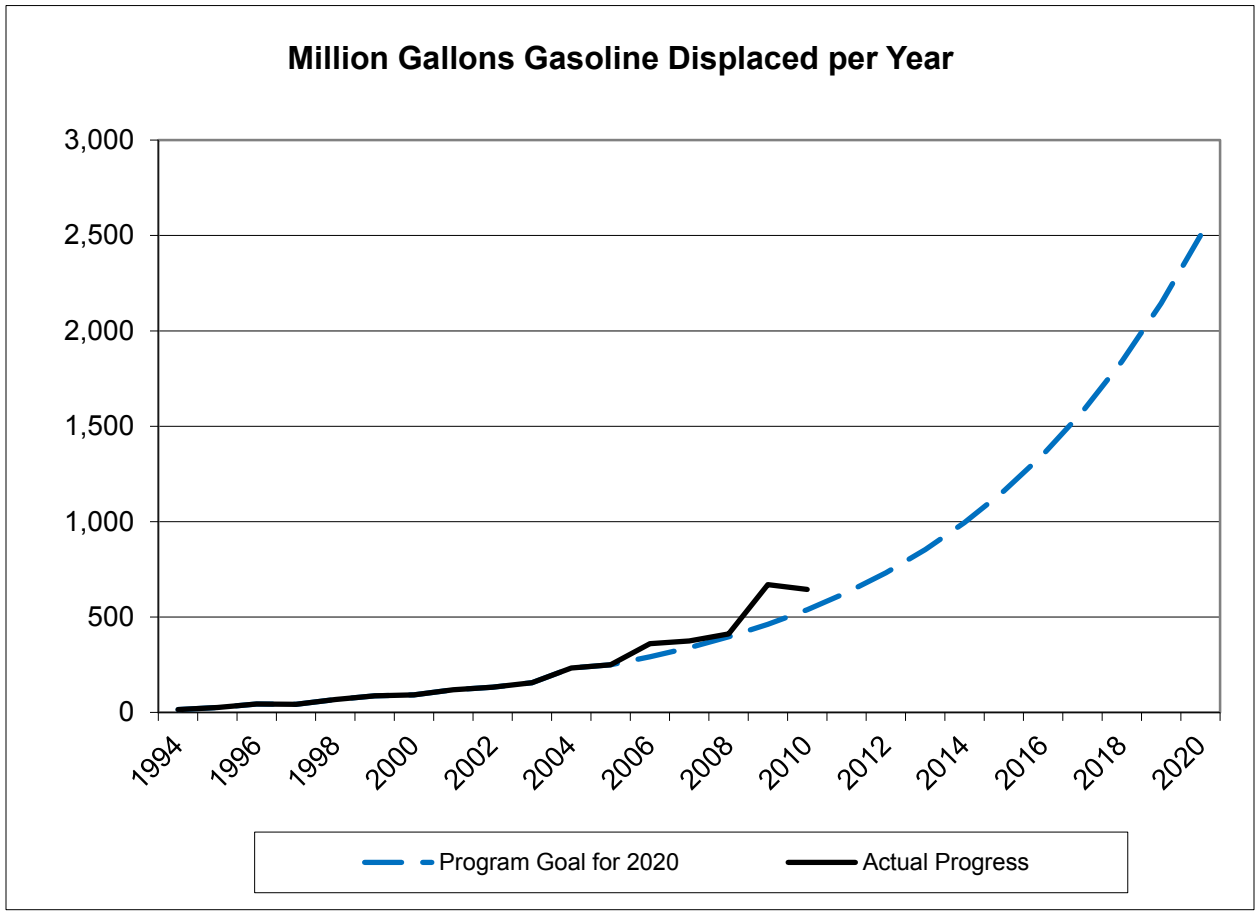

Figure 6. Annual petroleum savings trajectory to meet 2020 goal and actual progress

Greenhouse Gas Emissions Reduction

Clean Cities petroleum use reduction leads to a substantial reduction in GHG emissions, the pollutants responsible for global climate change. To estimate the GHG reductions resulting from Clean Cities activities, the author used a variation of Argonne National Laboratory's Greenhouse Gas, Regulated Emissions, and Energy Use in Transportation (GREET) model. This model takes into account the lifecycle, or "well to wheels," GHG emissions for transportation fuels, which include fuel production, transport, and use in the vehicle. It does not take into account the emissions from indirect land use changes or vehicle manufacturing. Table 7 contains Clean Cities 2010 GHG emissions reductions by technology type. The table also indicates the number of passenger cars that would need to be removed from the road to achieve an equivalent reduction in GHG emissions.

Table 7. GHG Emissions Reduced by Clean Cities in 2010

Technology	Tons of GHG Reduced	Equivalent Cars Removed*	Percent of Coalition Total
Alt Fuels & Vehicles	721,278	134,284	44%
Idle Reduction	307,275	57,192	19%
VMT Reduction	286,152	53,260	17%
HEVs	210,380	39,157	13%
Off Road Vehicles	65,572	12,205	4%
FE Improvements	54,407	10,126	3%
Coalition Reported Total	1,644,943	306,166	100%
Outreach Events	1,845,242	343,446	
ORNL Fuel Economy	882,661	164,286	
AFDC	149,347	27,797	
Grand Total	4,522,192	841,695	

* Calculated as total passenger car GHG emissions (Table 2–15 in the EPA's Inventory of GHG Emissions and Sinks) divided by total passenger cars (Table 1–11 in the Bureau of Transportation Statistics' National Transportation Statistics)

Alternative fuels and vehicles were responsible for more GHG reductions than any other coalition-reported activity. These reductions were calculated by subtracting the lifecycle GHGs emitted from the use of an alternative fuel from the lifecycle GHGs emitted from using gasoline or diesel in an equivalent vehicle. For the purposes of these calculations, gasoline is considered

the base fuel for all light-duty vehicles (LDVs) except biodiesel, which is used in a diesel (compression-ignition) vehicle. Diesel fuel is considered the base fuel for HDVs using all alternative fuels except E85, CNG, LNG, and LPG because these vehicles are equipped with spark-ignition (gasoline-like) engines. Figure 7 shows which fuels were used to achieve these reductions and how many AFVs were required for a given reduction. Note that the GHG reductions are not necessarily proportional to the petroleum displacement shown in Figure 6. This discrepancy occurs because various alternative fuels emit different amounts of GHGs over their lifecycle. Also note that the outreach events and ORNL fuel economy activities have a disproportionately high reduction of GHGs compared to their petroleum displacement. This is because they are more heavily focused on idle reduction, fuel economy improvements, and VMT reduction than other coalition operations. These three technologies eliminate 100% of the GHG emissions per gallon of petroleum saved, while alternative fuels reduce GHG emissions by a lesser amount per gallon of petroleum saved.

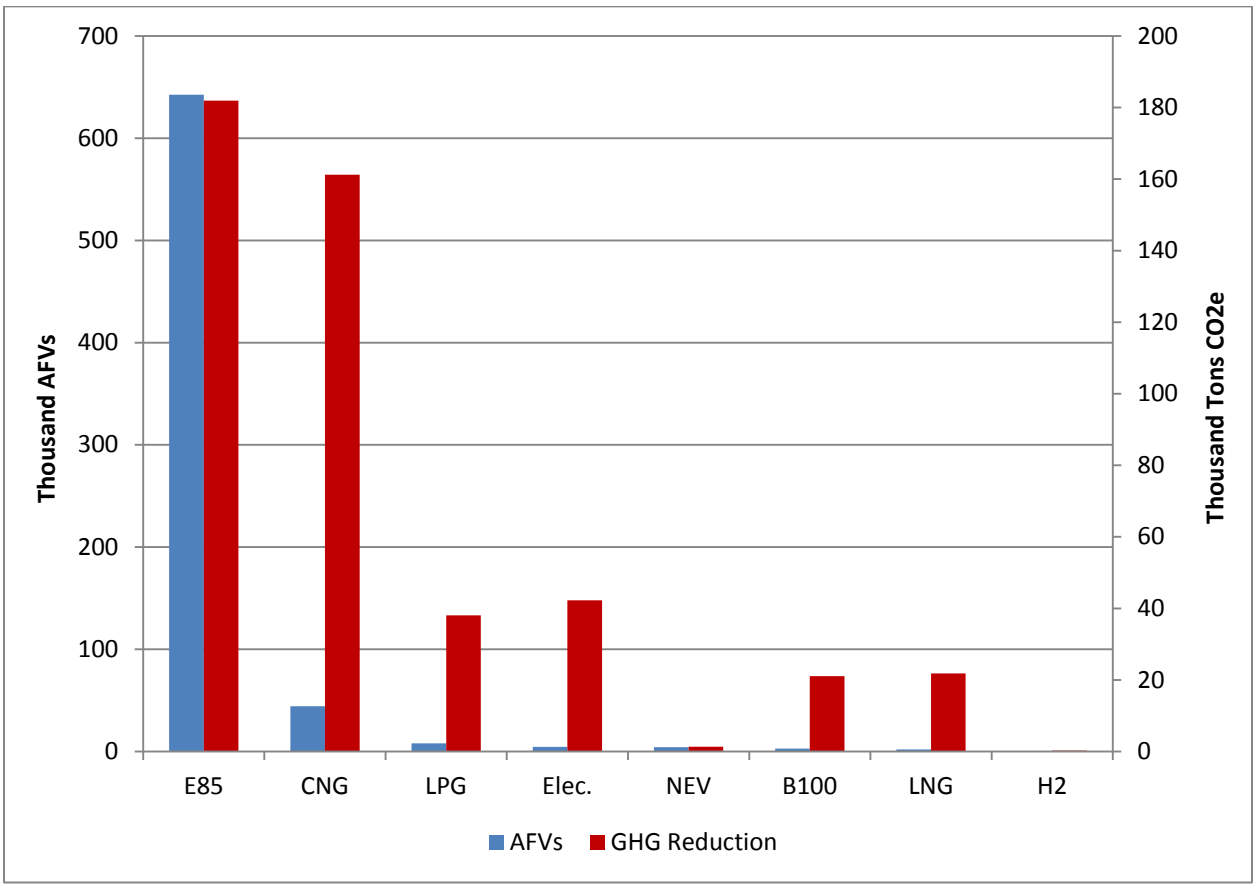

Figure 7. Number of AFVs and amount of GHG reduction by fuel type

Off-Road Vehicles

Alternative fuels are used in off-road applications, as well as on-road applications. Table 8 shows the number of AFVs (or pieces of equipment) reported by coalitions in 2010. Most of these categories are self-descriptive except construction equipment (such as cranes and earth movers) and recreation equipment (such as jet skis, snowmobiles, and all-terrain vehicles). The number of alternative fuel off-road vehicles increased 286% from 2009 to 2010, most likely because more coordinators reported in this relatively new category. Fuel type was reported, with biodiesel accounting for 70% of the AFVs. Less popular fuels were electricity (14% of equipment), LPG (9%), and gasoline HEVs (5%). The other fuels each accounted for less than 2% of the total.

Coordinators reported how much fuel these vehicles used, which the reporting website converted into petroleum savings. Overall savings from off-road vehicles was 8 million gallons—13 times greater than last year. Particularly popular fuel-application combinations included (in order of most to least popular) biodiesel construction and mining equipment, LPG forklifts, electric forklifts, and biodiesel farm equipment. The various applications varied widely in the number of GGEs displaced per vehicle, as shown in Table 8.

Table 8. Number of Non-Road Vehicles or Equipment and Petroleum Saved

Application	Number of Vehicles	GGEs Saved	GGEs per Vehicle
Construction equipment	5,671	1,399,703	247
Other	2,625	4,019,234	1,531
Forklifts	1,287	79,666	62
Mining equipment	900	1,943,624	2,160
Farm equipment	598	182,203	305
Landscaping equipment	378	75,132	199
Recreational equipment	98	1,817	19
Planes	70	258,606	3,694
Railroads	5	31,663	6,333
Ships	4	47,591	11,898
Total	11,636	8,039,239	Average: 691

AFV Types and Markets

The online reporting tool asked coordinators to categorize their AFVs into key vehicle types and niche market fleets. Table 9 shows that the majority (56%) of AFVs are light trucks. "Unknown" or "other" vehicle types are the second largest category at 17% of the AFVs. The majority of these "unknown" vehicles use E85 or biodiesel so were likely tracked by the fuel retailer rather than a fleet operator. These vehicles are likely light trucks if they were using E85 and light trucks or HDVs if they were using biodiesel. Cars were the third most numerous AFV, at 15% of the total, and none of the other categories surpassed 4% of the vehicle population. Please note that the vehicle type and market is not currently tracked for HEVs.

Table 9. Number and Type of AFVs by Fuel Type

Vehicle Type	E85	Biodsl	CNG	LPG	Elec	LNG	NEV	H2	Other	Total
Pickup/SUV/Van	286,773	16,204	7,852	2,211	269	0	48	22	20	313,399
Unknown/Other	46,354	31,592	5,524	6,563	2,035	346	1,530	5	125	94,074
Car	61,677	2,271	15,674	352	2,498	0	1,592	25	1,288	85,377
Delivery Truck	13	18,128	1,701	1,021	32	31	0	4	7	20,937
Transit Bus	0	6,062	8,375	336	583	1,147	0	6	3	16,512
Refuse Truck	0	9,021	591	80	20	1,002	0	0	0	10,714
Patrol Car	9,040	0	198	6	5	0	0	0	0	9,249
School Bus	0	3,903	1,079	1,435	1	59	0	0	7	6,484
Semi-trailer truck	0	1,263	58	125	0	825	0	0	0	2,271
Shuttle Bus	0	264	1,505	149	23	0	0	0	0	1,941
Taxi Cab	124	18	307	918	40	0	0	0	0	1,407
Motorcycle	0	0	0	0	3	0	147	0	0	150
TOTAL	403,981	88,726	42,864	13,196	5,509	3,410	3,317	62	1,450	562,515

In addition to vehicle type, coordinators were also asked to report which market the vehicle served or who owned the vehicle. As shown in Figure 8, two-thirds of the vehicles were owned by the general public or an unknown entity. Many of these vehicles were reported through fuel retailers. The next two largest owners of AFVs are state and local governments, at 13% and 12%, respectively. These numbers are not comparable to the 2009 numbers since the categories changed in 2010, and reporting market type was made mandatory.

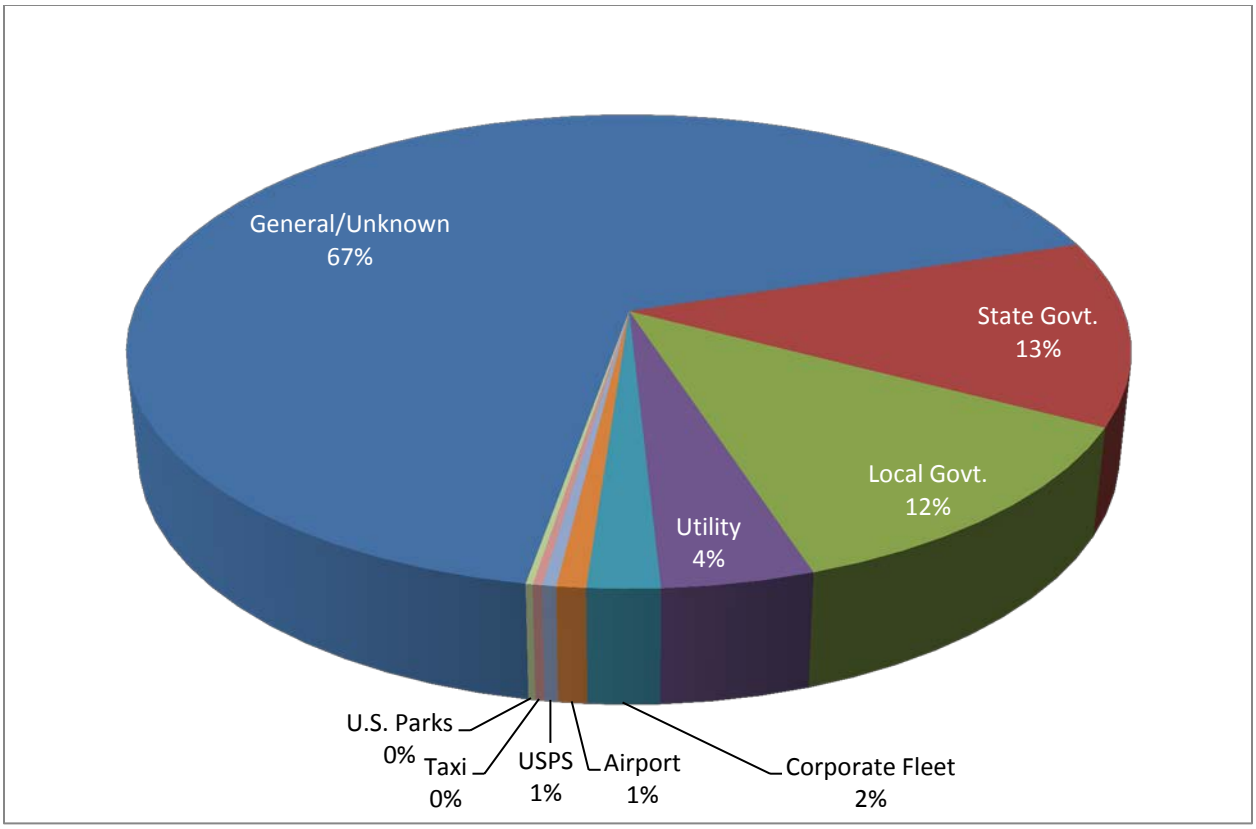

Figure 8. Percentage of total AFVs by market/owner

About the Coordinators

Coordinators reported spending a total of 2,648 hours per week on Clean Cities tasks, or nearly 130,000 hours throughout the year. This translates to more than 66 full-time, experienced technical professionals working to reduce U.S. dependence on oil. For an individual coalition, the average amount of time spent coordinating Clean Cities business per week was 30 hours, which is also the median amount of time. Both the total hours and the average hours increased 7% from 2009, while the median hours per coordinator increased 20%. This implies that many of the coordinators who spent less than 25 hours per week on Clean Cities last year were able to spend more time on it in 2010.

The reporting website also gathered information on coordinator experience. On average, coordinators have been on the job for 5.3 years. Half of the coordinators have had more than four years of experience as of 2010, and half have had four or fewer years of experience. The three longest serving coordinators have been with Clean Cities for at least 16 years.

Project Funding

In 2010, 59 coalitions reported receiving 198 project awards (project-specific grants) worth a total of $232 million. These coalitions also reported garnering an even greater amount ($320

million) in leveraged, or matching, funds, for a combined total of $550 million. This funding represents a 21:1 leveraging of the $26 million program budget in FY 2010. Of the 198 awards, the value of 13 each exceeded $10 million, and five awards totaled $15 million each. Table 10 presents the breakdown of the number and value of awards reported by the coalitions.

Table 10. Breakdown of 2010 Project Awards by Number and Value

Size Category	Number	% of Total Number	Total Value	% of Grand Total Value
< $50,000	95	48%	$1,558,099	1%
$50,000–$99,999	25	13%	$1,714,726	1%
$100,000–$499,999	40	20%	$9,871,130	4%
$500,000–$999,999	10	5%	$6,532,272	3%
$1M–$9.9M	15	8%	$41,528,542	18%
$10M–$15M	13	7%	$171,225,699	74%
Grand Total	198	100%	$232,430,468	100%

2010 is the first year coordinators reported how much of a multi-year award was spent during the calendar year. If they didn't report the amount spent during 2010, it was assumed to be the total amount of the award divided by the number of years of award duration. Coalitions reported already spending 24% of the awards that they were awarded in 2010, suggesting that projects were started quickly.

The American Recovery and Reinvestment Act (ARRA) was signed into law on Feb. 17, 2009, for the purpose of creating jobs in all areas of the country and spurring future economic development in key areas such as clean energy. Clean Cities proved to be a highly effective avenue through which to identify effective projects across the nation and quickly fund them. In 2009, more than $190 million of the award funding reported by Clean Cities coalitions came from ARRA, and that money attracted $176 million in leveraged funds. In 2010, 48 more ARRA awards were distributed through 33 coalitions. These awards totaled $158 million and leveraged $241 million in matching funds. This $158 million in ARRA awards represents 29% of the total project funding that coalitions brought in.

Of the $550 million in project awards and leveraged funds in 2010, $53 million (10%) was listed as coming from DOE independent of ARRA. Funding from Clean Cities coalition support contracts were not included among the project awards since they are intended to fund coalition operations instead of specific projects.

About the Stakeholders

In 2010, 88 coalitions reported a total of 10,430 stakeholders for an average of 119 stakeholders per coalition. These data indicate Clean Cities coalitions are growing: 1,945 of the 10,430 stakeholders were added in 2010 for an average of 22 new recruits per coalition. This makes for an average coalition growth rate of 23%.

Participation in Clean Cities is voluntary, and coalitions draw local stakeholders from the public and private sectors. Stakeholders include local, state, and federal government agencies; public health and transportation departments; transit agencies and other government offices; and auto manufacturers, car dealers, fuel suppliers, public utilities, and professional associations. Coalitions reported that 50% of the total stakeholders were from the private sector. This composition represents a slight shift (3%) from public to private stakeholders in 2010.

Data Sources and Quality

Gathering data is always challenging for the coordinators, because they rely on voluntary reporting from their stakeholders. Therefore, the annual report website contains some questions relating to coordinator sources and data quality. In these questions, coordinators were asked to rate the quality of their data as excellent, good, fair, or poor. The "cumulative" bar in Figure 9 presents the response breakdown for the 88 coordinators who answered the question. Twenty percent of the respondents classified their data as excellent, 71% as good, 15% as fair, and 4% as poor. Relative to 2009, there was a 10% shift from the poor and fair categories to the good and excellent categories.

Coordinators were also asked how they obtained their data. They could choose one or more of the following: written (paper or electronic) questions to stakeholders, phone interviews with stakeholders, coalition records, or coalition estimates. Written questions were the most used method of data gathering, accounting for 32%. The next most used method was phone interviews (28%), then coalition records (23%), and finally estimates (17%). When compared to 2009, this breakdown represents a slight shift from written questions and estimates to coalition records and phone calls. Figure 10 shows that written questions and phone calls resulted in slightly (6%) higher rate of combined "excellent" and "good" data than did the coalition records or estimates. This is likely due to coordinators' confidence in numbers that come from the stakeholder fleets as opposed to the numbers they track or estimate themselves.

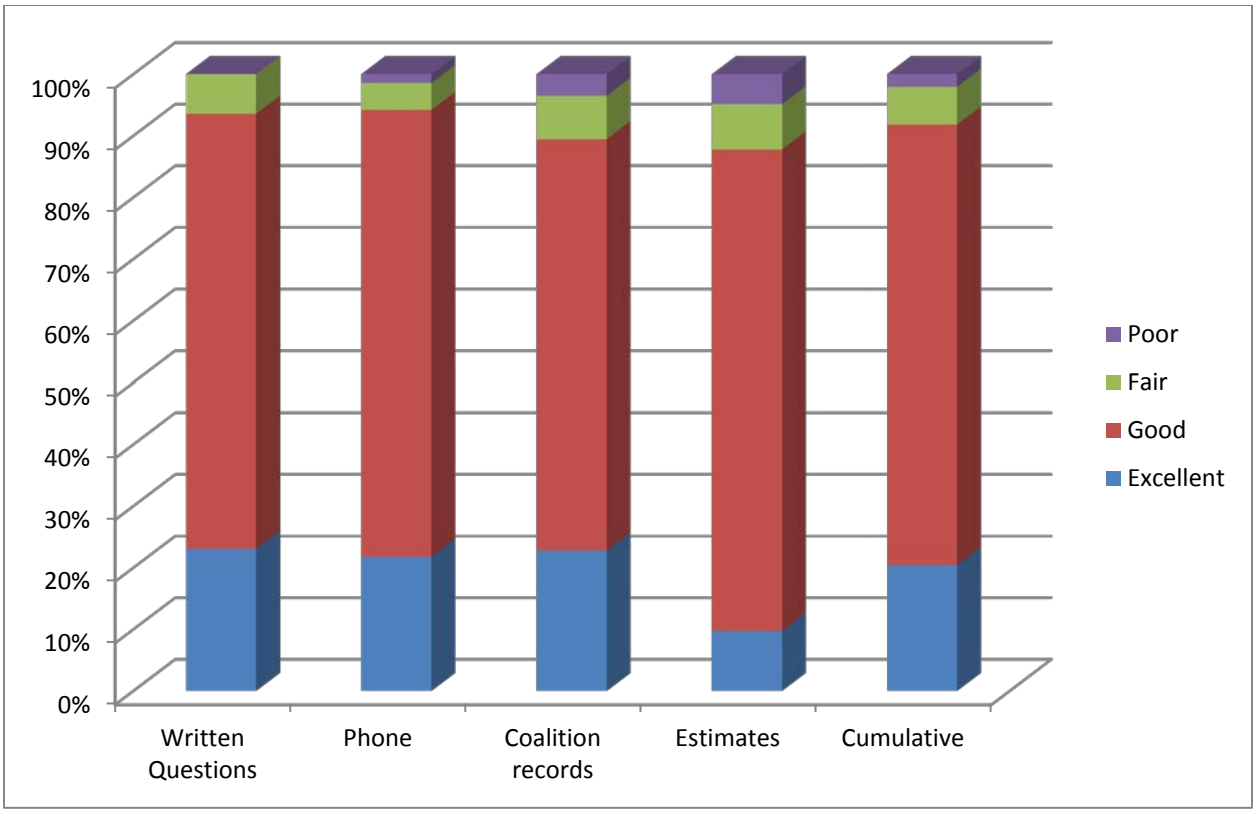

Figure 9. Data quality responses by data source

Conclusion

The Clean Cities 2010 Annual Metrics Report helps quantify the impact of the program as a whole and of the activities of individual coalitions. NREL believes the calculated impacts are a conservative measure of the coalitions' overall impact, because the ability of coordinators to gather specific data about their activities is, by its very nature, limited. Furthermore, the ripple effects of their efforts in local communities are difficult to quantify. Clearly, though, the combined efforts of DOE, its national laboratories, and local Clean Cities coalitions bring together otherwise disparate groups and funding sources to accelerate the nation's progress toward petroleum savings, and thereby, toward improved energy independence, economic security, and environmental protection.

Appendix A: Clean Cities Coalitions that Completed 2010 Annual Reports

State	Coalition
AL	Alabama Clean Fuels Coalition
AR	Arkansas Clean Cities
AZ	Tucson Clean Cities
AZ	Valley of the Sun Clean Cities (Phoenix)
CA	Antelope Valley Clean Cities
CA	Central Coast Clean Cities
CA	Coachella Valley Region Clean Cities
CA	East Bay Clean Cities (Oakland)
CA	Long Beach Clean Cities
CA	Los Angeles Clean Cities
CA	Sacramento Clean Cities
CA	San Diego Clean Fuels Coalition
CA	San Francisco Clean Cities
CA	San Joaquin Valley Clean Cities
CA	Silicon Valley Clean Cities (San Jose)
CA	Southern California Clean Cities
CA	Western Riverside County Clean Cities
CO	Denver Clean Cities
CO	Northern Colorado Clean Cities
CO	Southern Colorado Clean Cities
CT	Capitol Clean Cities of Connecticut
CT	Connecticut Southwestern Area Clean Cities
CT	New Haven Clean Cities
CT	Norwich Clean Cities
DC	Washington DC Metropolitan Clean Cities
DE	State of Delaware Clean Cities
FL	Gold Coast Clean Cities (Miami/Fort Lauderdale/West Palm Beach)

State	Coalition
FL	Space Coast Clean Cities (Orlando)
GA	Atlanta Clean Cities
GA	Middle Georgia Clean Cities
HI	Honolulu Clean Cities
IA	State of Iowa Clean Cities
ID	Treasure Valley Clean Cities
IL	Chicago Clean Cities
IN	Greater Indiana Clean Cities
IN	South Shore Clean Cities
KS	Kansas City Regional Clean Cities
KY	Commonwealth Clean Cities Partnership
LA	Greater Baton Rouge Clean Cities
LA	Southeast Louisiana Clean Fuels Partnership
MA	Massachusetts Clean Cities
MD	State of Maryland Clean Cities
ME	Maine Clean Communities
MI	Ann Arbor Clean Cities
MI	Detroit Clean Cities
MI	Greater Lansing Clean Cities
MN	Twin Cities Clean Cities
MO	St. Louis Clean Cities
NC	Centralina Clean Fuels Coalition
NC	Land of Sky Clean Vehicles Coalition
NC	Triangle Clean Cities (Raleigh, Durham, Chapel Hill)
ND	Red River Valley Clean Cities
NH	Granite State Clean Cities

State	Coalition
NJ	New Jersey Clean Cities
NM	Land of Enchantment Clean Cities (New Mexico)
NV	Eastern Sierra Regional Clean Cities (Reno)
NV	Las Vegas Clean Cities
NY	Capital District Clean Cities (Albany)
NY	Central New York Clean Cities (Syracuse)
NY	Clean Communities of Western New York (Buffalo)
NY	Genesee Region Clean Cities (Rochester)
NY	Greater Long Island Clean Cities
NY	New York City and Lower Hudson Valley Clean Communities
OH	Clean Fuels Ohio
OH	Northeast Ohio Clean Transportation (Cleveland)
OK	Central Oklahoma Clean Cities (Oklahoma City)
OK	Tulsa Clean Cities
OR	Columbia-Willamette Clean Cities
OR	Rogue Valley Clean Cities
PA	Philadelphia Clean Cities
PA	Pittsburgh Clean Cities
RI	Ocean State Clean Cities
SC	Palmetto State Clean Cities
TN	East Tennessee Clean Fuels Coalition
TN	Middle Tennessee Clean Cities
TX	Alamo Area Clean Cities (San Antonio)
TX	Central Texas Clean Cities (Austin)
TX	Dallas-Ft. Worth Clean Cities
TX	East Texas Clean Cities

State	Coalition
TX	Houston-Galveston Clean Cities
TX	South East Texas Clean Cities (Beaumont-Port Arthur)
UT	Utah Clean Cities
VA	Virginia Clean Cities
VT	State of Vermont Clean Cities
WA	Puget Sound Clean Cities (Seattle)
WI	Wisconsin Southeast Area Clean Cities
WV	State of West Virginia Clean Cities
WY	Yellowstone Teton Clean Energy Coalition